

WIRELESS TELEGRAPHY.

A History of Wireless Telegraphy, 1838-1899. By J. J. Fahie, M.I.E.E., &c. Pp. xvii + 325. (Edinburgh and London: William Blackwood and Sons, 1899.)

La Télégraphie sans Fils. Par André Broca. Pp. vii + 202. (Paris: Gauthier-Villars et Fils, 1899.)

WIRELESS telegraphy is a subject of absorbing popular interest at the present time. Its sensational possibilities are being gradually demonstrated; and just now a special popular interest arises from its obvious applicability to the amelioration of the state of isolation of our beleaguered garrisons in South Africa. Telegraphy without tangible means of communication has, however, proved an attractive field of inquiry almost since Volta's discovery of the electric current a century ago. And when in later years the submarine cable became a success, the high earning power, and the high cost also, served both to attract and to stimulate many inventors and scientific enthusiasts in their search for a system of telegraphy which would dispense with the costly cable.

The first of the two books here noticed contains matter of great interest, and is written by an authority on the history of telegraphy. Mr. Fahie has unearthed with much diligence a great mass of almost, or quite, forgotten experimental work (largely relating to efforts based on the conducting power of water). This, together with descriptions of the more recent work of Preece, Lodge, Marconi and others, he presents to the reader chiefly in the form of copious extracts from original papers.

One is able to gain an idea from this book of the immense amount of experimental work continually being carried out; to be noticed possibly in the current literature of the day, and then to be forgotten save when some striking practical success, such as that of Marconi, calls forth a historian who will rescue such work from oblivion.

For a frontispiece, the book has a collection of small but excellent portraits of "the arch builders of wireless telegraphy," from Oersted to Marconi; and at the end are gathered a number of extracts embodying the views of Lodge, Henry and Rowland, followed by Prof. Branly's classical paper on the behaviour of imperfect contacts to electrical radiation, and by a most interesting letter to Mr. Fahie by Prof. Hughes, describing his hitherto unpublished work on what are now called "coherers," which he was led to carry out after his invention of the microphone in 1877. The book concludes with a reprint of Marconi's patent of 1896, which shows how extensive his experiments had been before he came to England.

All these appendices are worthy of the most careful reading in the light of recent events. In fact, the book teems with interesting matter from cover to cover.

While the work is certainly opportune, yet a careful perusal brings us to the rather opposite conclusion that it is also premature. It is opportune, for a work on wireless telegraphy from an authority like Mr. Fahie is very welcome now. It is premature, in that the subject is changing so rapidly that a consistent account is impossible. For Marconi's present arrangement, though arrived at after the most careful investigation, yet seems to be still very empirical, as for example in the almost

arbitrary choice of the kind of electric waves or of coherers, out of the infinite variety of both which are possible. It is still to be hoped that some other set of waves and some different type of coherer may be found equally available, and furnishing and receiving signals more amenable to projection in any required direction. Success in localising the electric waves is vital to the extended adoption of wireless telegraphy, yet Mr. Fahie is of course unable to include an account of this part of the subject in his book.

The author has adopted a chronological arrangement. No other seems in fact possible. Yet we think that many would prefer the accounts of mere *conduction* experiments to be kept separate from *etheric* telegraphy. Among other anomalies of arrangement we may mention that Lodge's work on wireless telegraphy is described under the general title of "G. Marconi's Method" (pp. 227-235).

Apart from obsolete expressions and unfortunate quotations from public utterances (as, "the Röntgen form of telegraph," p. viii.), the author's own language is not always precise. Thus "a rapidly revolving rheotome which broke up the current into a musical note" (p. 152), though perhaps expressive, is not accurate. Again, the reference to Hertz's "experimental proof of the hitherto theoretical fact" (p. 183), of the identity of the velocity of propagation of light and of electric waves, is hardly felicitous. Some of the author's elucidations of theory, also, are not perhaps as clear as they might be. An edition prepared at greater leisure, however, would no doubt be free from such passages.

The most obvious criticism of the book relates to the disjointed reading which arises from the author's very frequent insertion of extracts. But this criticism Mr. Fahie meets half way, for in his preface he "seems to hear the facetious critic exclaim, 'Why, this is all scissors and paste,' and he rejoins, 'So it is, much of it'; and he further adds that 'so is all true history when you delete the fictions with which many historians embellish their facts.'" If this rather pessimistic view be adopted, then it would seem that a readable history is an impossibility. At all events, we certainly think that the constant change in literary style, both in character and quality, combined with the obsolete scientific expressions in which many of the extracts are couched, does not contribute to make the book readable. Indeed, we would describe the book as an excellent and well arranged store of material for writing a book on wireless telegraphy. It may be, however, that the attempt to render a *history* readable is to be deprecated.

The author has dedicated his work to Sir William Preece. Its later chapters bear witness to the striking way in which a Government department has so consistently and actively encouraged advance and scientific investigation wherever results of importance to its own work were to be hoped for.

There remains to state in conclusion that Mr. Fahie's book is certainly the best, if not the only work of reference which has appeared on the history of wireless telegraphy.

For a lucid and thoughtful exposition of the theory of the propagation of electric waves we can cordially

recommend a little book by M. André Broca, "La Télégraphie sans Fil," which has lately been published. Within the compass of two hundred small pages of large print will here be found, first, a description of simple telegraphic apparatus; then a number of chapters which, with the help of hydraulic analogy, serve in an effective and remarkable manner to introduce the electromagnetic theory of light; and, lastly, a good account of the action of the vertical-wire transmitter and of the most recent work on coherers.

M. Broca succeeds in giving in simple scientific language, and without the help of mathematical analysis, an explanation of many abstruse points, such as the flow of electric currents in submarine cables and of electric waves along wires.

The vertical wire, according to him, emits an electric disturbance having an axis of symmetry, the wire itself; and a wave having this quality distributes its energy mostly in a plane perpendicular to the axis, a horizontal plane in this case, the energy diminishing with the square of the cosine of the angle from the vertical axis. It is to this concentration of energy in a horizontal plane that the vertical wire owes its success as a transmitter, but real concentration of messages transmitted by this means is not to be expected. (The employment of two or more wires inclined at different angles in the same vertical plane, but not necessarily close together, might possibly, we think, furnish by the intersection of two or more planes of greatest action, a *line* of reinforced action—a kind of imperfectly *directed* message which might be received by an arrangement similar to the transmitter.)

An appendix gives in a few pages the mathematical theory of the propagation of waves along a conductor.

M. Broca's little book is a valuable addition to the fast accumulating literature of wireless telegraphy, and we shall be glad to see an English translation.

D. K. M.

WORK AND THOUGHT AT WOOD'S HOLL, U.S.A.

Biological Lectures from the Marine Biological Laboratory, Wood's Holl, Massachusetts, 1898. Pp. 343. (Boston: Ginn and Co, 1899.)

THIS volume, like its predecessors, is the joint production of several of the leading biologists of the United States, indicative to a certain extent of the trend of thought and investigation in their midst, and, like its predecessors, it teems with interest and suggestiveness. Of the sixteen lectures reported, the majority are by well-known authors, and the book is remarkable for the extent to which it deals with questions of a cytological and psychological nature, in contradistinction to those of a more strictly morphological, such as we are accustomed to associate with a marine laboratory. Not that the latter have been neglected! for a remarkable essay by A. D. Mead, on the "Cell Origin of the Prototroch," which would seem to justify once more the belief in the ancestral nature of the Trochophore larva, is a thorough-going piece of sea-side work. The subject of "Cell-Lineage and Ancestral Reminiscence," in the hands of Prof. E. B. Wilson, yields fresh support for the theory that homologies only gradually arise

during development, and that "the ultimate court of appeal lies in the fate of the cells"; and in a preliminary account of some investigations into the "Structure of Protoplasm" the same author is led to conclude, with von Kölliker, basing his observations of the Echinoderm egg, that "no universal or even general formula for protoplasmic structure can be given, and that the foam-structure of Bütschli is in certain cases at least of secondary origin."

In the course of his work he has done a great service in pointing out that so-called "granules" are often really liquid in nature, and in emphasising the extent to which error has hitherto arisen from the general tendency to regard these as solid bodies.

Among the more recondite problems dealt with are "Adaptation in Cleavage" of the Egg, "Protoplasmic Movement as a Factor of Differentiation," "Equal and Unequal Cleavage in Annelids," and "The Relation of the Axis of the Embryo to the First Cleavage Plane." In the hands of Messrs. F. R. Lillie, E. G. Conklin, A. L. Treadwell and Miss C. M. Clapp, both the practical and philosophic aspects of these and cognate subjects receive adequate consideration. The whole series of essays are well worth reading, and except that the Filose Phenomenon has not come under observation, the present moot points in embryology have been for the most part boldly attacked. Interest amounting to curiosity attaches to the description by Mr. Lillie in *Unio* of what, following Conklin, he terms provisionally a "sphere-substance," said to be "derived entirely from the inner sphere of the second maturation-spindle," and to his allegation, which seems to us none too clear, that it "moves and elongates so as to mark out a definite horizontal plane in the egg, and that the first cleavage-spindle places itself in conformity with this predetermined arrangement."

More sensational, and to our thinking less sound, is a lecture by T. H. Montgomery, jun., on some "Observations on Various Nucleolar Structures in the Cell." Like that on "The Heredity of the Marking in Fish Embryos" (J. Loeb), and on "Injury" to the Lower Animals as concerning "Pain Sensations" (W. W. Norman), this appears to us premature, and the authors would have done well had they given both their observations and reflections fuller consideration. An essay on "Some Problems of Regeneration," by T. H. Morgan, is noteworthy, for the fact that its author emphasises the degree to which it is now becoming evident in the progress of biology, that, as we attempt "to reduce living phenomena to simpler terms," we sooner or later "meet with a factor that defies further physical analysis," with the refrain that "we gain nothing by calling it a vital force, unless we can define what we mean by vitality."

In a lecture on the "Elimination of the Unfit," Dr. H. C. Bumpus deals in an analytical form with the effects of a severe storm on the Introduced Sparrow, and his observations at least serve to remind us that we are perhaps not sufficiently on the alert for evidence of processes in organic evolution obtainable from the study of passing events. Dr. W. M. Wheeler, in an interesting essay on "The Theoria Generationis" of Wolff, justly controverts some adverse criticism by Sachs, and establishes Wolff's position as a pioneer among præformationists—